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WATER POLLUTION PROBLEMS OF THE GREAT LAKES AREA

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
CHICAGO, ILLINOIS

SEPTEMBER 1966

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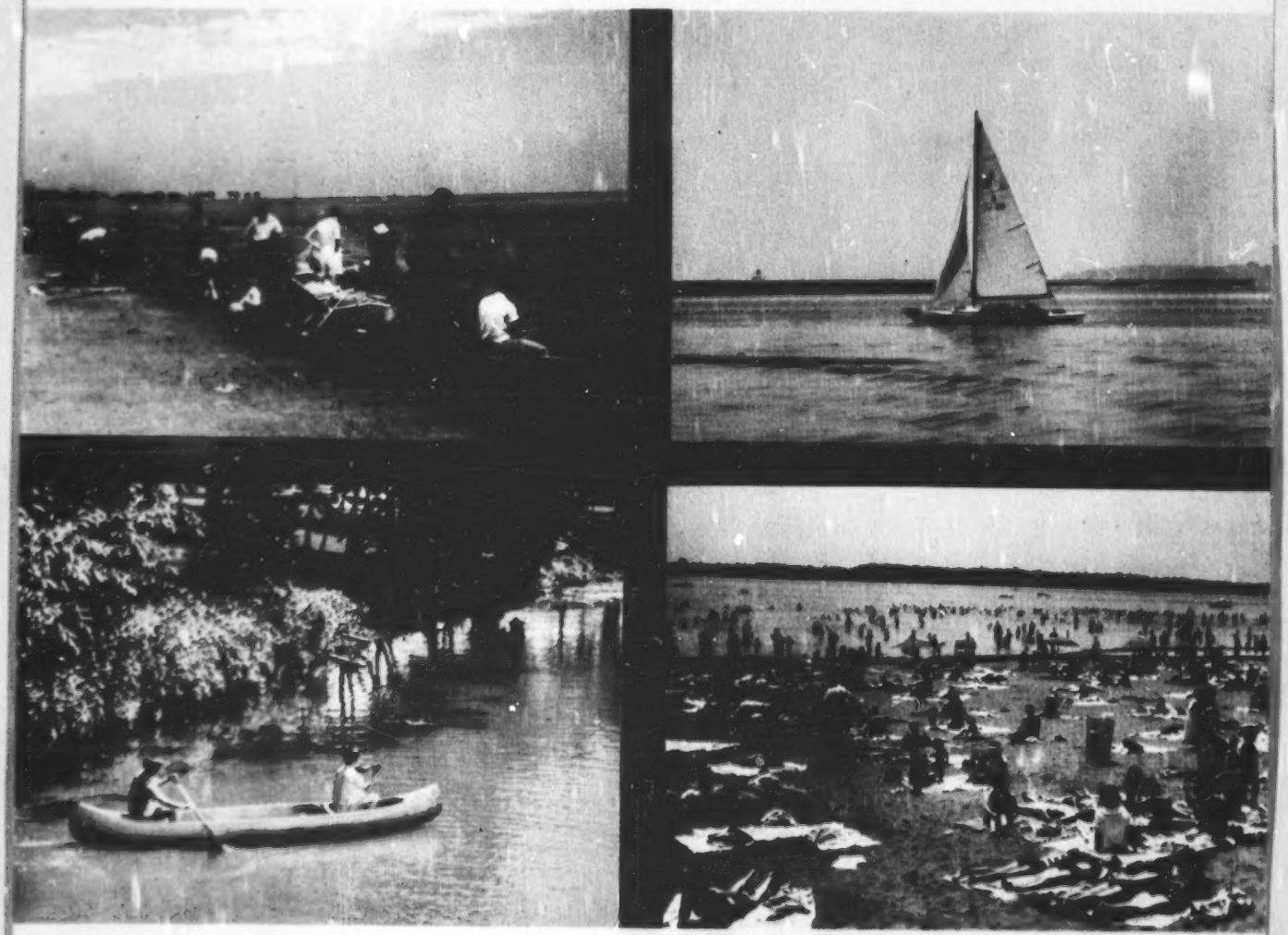
WATER POLLUTION PROBLEMS



OF THE GREAT LAKES AREA

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The water pollution problems of the Great Lakes area are reviewed in terms of their various effects and what is being done to correct them. Problems are identified as: over-enrichment of the lakes; build-up of dissolved solids; bacterial contamination of the lakes and tributaries; chemical contamination from industrial waste discharges; and oxygen depletion of the lakes and tributaries. Management problems are also described along with federal, state, regional, local, industrial interstate and international action.

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WATER POLLUTION PROBLEMS OF THE GREAT LAKES AREA

September 1966

UNITED STATES DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
Great Lakes Region Chicago, Illinois

Great Lakes-Illinois River Basins Project

- FOREWORD
- IMPORTANCE OF THE GREAT LAKES
- WATER POLLUTION PROBLEMS
- WHAT IS BEING DONE
- ACTION NEEDED

FOREWORD

The fight for clean waters is being pressed today as never before. At the signing of the Water Quality Act of 1965 on October 2, 1965, President Johnson said, in part:

> "...This moment marks a very proud beginning for the United States of America. Today, we proclaim our refusal to be strangled by the wastes of civilization. Today, we begin to be masters of our environment.
>
> "But we must act, and act swiftly. The hour is late, the damage is large...
>
> "No one has a right to use America's rivers and America's waterways that belong to all the people as a sewer...
>
> "...This bill that you have passed, that will become law as a result of a responsive Congress, will not completely assure us of absolute success. Additional bolder legislation will be needed in the years ahead. But we have begun. And we have begun in the best American tradition - with a program of joint Federal, state and local action..."

That Congress was in a mood for bolder legislation is evidenced by subsequent congressional actions. The Washington Post on July 15, 1966, in an editorial typical of many throughout the Nation, commented on current legislative action as follows:

> "The 90-to-0 vote by which the Senate passed the clean-rivers bill is indicative of a tidal wave of reaction against filth in our streams. A few years ago it was difficult to arouse any interest in pollution or its abatement on a national scale. Now there is mounting alarm, and, according to Senator Muskie, the chief sponsor of the Senate bill, the people have given a mandate to Congress to end the shocking abuse of our water resources."

Nowhere in the Nation is the tidal wave of reaction - the mounting alarm over pollution - more evident than in the Great Lakes Area. Governors of the Lake States have given strong support to water pollution control - convening top-level conferences, promoting State programs of financial aid to cities as a supplement to Federal construction grants, and initiating action toward establishing standards for enhancing water quality.

Once buried on the back pages of newspapers, water pollution is now front-page news. Civic groups, labor unions, and crusading private citizens have added their voices to those of public health and conservation spokemen.

The present generation holds the Lakes in trust, with an obligation to posterity to pass along this magnificent resource in the best possible condition.

The water pollution problems of the Great Lakes are myriad and complex. But the will to do something about it is strong. Ways will be found. Some of the ways are described in the narrative that follows.

IMPORTANCE OF THE GREAT LAKES

The Great Lakes Area (see map in the middle of this booklet) is characterized by large concentrations of people, industry and fresh water. In 1960 more than 25 million people lived within its boundaries; more than 20 million or 80 percent of the total live in metropolitan areas. In 1963 manufacturing activity exceeded 40 billion dollars - almost one-fourth of the Nation's total. For many decades much of the area has been referred to as the industrial belt of the Nation. The area has the largest, most dependable, and most valuable fresh water resources in the United States. It is imperative that they not be lost or degraded. Not only is a large part of the existing population and industry of our country dependent upon them, they also are vital to future growth. Within less than fifty years the population of the Great Lakes Area is expected to double, or exceed 50 million people; industrial activity during the same period may well increase four or even five-fold.

Industrial water use in 1960 in the Great Lakes Area was estimated to be 2,660 billion gallons. The quantity may triple within 50 years. These industries employed almost a half million persons. Municipal water use in the same year was approximately 1,400 billions of gallons. It may reach 3,000 billion by the year 2010. Municipal water facilities drawing water from the Lakes or connecting waters serve almost 15 million persons.

World's largest municipal water treatment plant - Chicago.

To state the value of the water resources to industry and for municipal consumption only partially tells the story. The importance of the Lakes and their tributaries for recreation and for commercial fishing, although difficult to measure in dollar terms, is clearly enormous. During the summer months of 1960 in the Lake Michigan Basin alone there were more than 50 million "activity days" of water-oriented recreation. If suitable facilities exist, the number may be five times as large by the year 2010. With regard to commercial fishing the U. S. catch in 1964 totalled over 53 million pounds - half of which was taken from Lake Michigan.

The enhancement of recreational opportunities, the improvement or maintenance of water quality for municipal and industrial use, and the over-all betterment of the esthetic aspects of lake shores and tributaries will result not only in dollar savings but also in greater personal enjoyment to millions of people. To a great extent the future growth of the area is dependent upon the adequacy of a suitable quantity and quality of its water resources.

Little waters of the
Big Lakes area.

WATER POLLUTION PROBLEMS

Physical Problems

When the Great Lakes were formed by receding glaciers some 20,000 years ago, their waters were excellent in quality. Although the overall quality remains generally good, particularly when compared to some of our severely polluted streams, it has undergone continuous deterioration as a result of waste inputs from natural runoff and the activities of man. The widely publicized water quality problems of Lake Erie dramatically emphasize the consequences of this deterioration.

The major physical problems of the Great Lakes Area are:

--- Over-enrichment of the Lakes.
--- Build-up of dissolved solids in the Lakes.
--- Bacterial contamination of the Lakes and Tributaries.
--- Chemical contamination from industrial waste discharges.
--- Oxygen depletion of the Lakes and Tributaries.

Discussion of each of these significant water quality problems follows.

Over-enrichment of the Lakes

Every lake, including our own Great Lakes, undergoes an aging process which is inevitable and leads - in time measured on a geologic scale - to its destruction. Of immediate concern, however, is not the lake's inexorable fate but the rate of its evolution. Aging is rapidly accelerated by inputs of nutritive materials, nitrogen and phosphorus, that enrich the aquatic environment. Fertilizers carried into a lake by land runoff, along with the nitrogen and phosphorus contained in municipal and industrial waste discharges, hasten the aging or eutrophication process.

At some stage in the life history of the lake, nutrient concentrations reach a level where the addition of more nutrients produces "blooms" of algae and the water becomes murky. Initially, the blooms are not dense but blooms of greater density follow, and the algal population and species change to the blue-green types that cause noxious odors and appear as unsightly scums on the water surface.

Concurrent with the development of algal blooms, other significant changes occur. Dissolved oxygen levels become depressed in the bottom of thermally stratified lakes. (See subsequent discussion of oxygen depletion.) Bottom-dwelling fauna change from clean water forms to pollution-tolerant forms. Drastic changes take place in the fisheries

with the highly-prized game fish, such as pike, trout and whitefish becoming scarce as the coarse, less valuable fish such as carp, catfish, and sheepshead become dominant. In shallow waters near shore, attached filamentous forms of algae grow abundantly, forming in long strings which break loose and wash up onto the shore. Unsightly odorous messes result, interfering with the recreational use of waters and beaches, clogging water intakes, and depressing property values.

Dead algae foul beaches and swimming waters.

Sad as it may seem, we have in effect just described the principal water quality problems in the smallest of our Great Lakes, Lake Erie. A Federal enforcement conference last August disclosed that 174,000 pounds of soluble phosphate are being discharged to Lake Erie each day. Algal concentrations have reached such proportions that extensive blooms have been observed. A bloom occurred in 1964 which affected 2,600 square miles of the central basin. Oxygen levels in the 2,600 square mile area, near the water bottom, were as low as zero to 2 milligrams per liter (mg/l). Algae in other areas of the Lake foul beaches and waterfront property, often result in filter clogging in water treatment plants, and produce taste and odors in drinking water under some conditions.

Evaluation of biological conditions in Lake Ontario shows that this Lake is on the verge of becoming eutrophic (waters with a good supply of nutrients and capable of supporting rich organic productions). The ability of the Lake to support algal blooms and great masses of attached filamentous forms of algae along the shoreline is a definite indication of eutrophication. Apparently the major reason Lake Ontario has not already become eutrophic is its deep waters.

In Lake Michigan enrichment of the waters has not reached the stages of Lakes Erie or Ontario. However, in isolated locations such as the southern part of Green Bay near the mouth of the Fox River, the Milwaukee Area and the Calumet Area, biological findings have indicated the presence of waters subject to organic enrichment. Much filamentous algae has been found at nearly every beach in the southwestern corner of the Lake. Clogging of water intake screens has caused serious trouble at Chicago's South District Filtration Plant.

The problems resulting from over-fertilization have been well-documented and pose a significant threat to the quality of the Great Lakes.

The continuing practice of dredging harbors and streams to maintain adequate navigation depths and the subsequent off-shore disposal of dredgings containing residues of municipal and industrial wastes is also a waste input of significance in the over-enrichment of the Great Lakes.

Many smaller lakes in the Great Lakes Area have reached a state of deterioration even more advanced than Lake Erie's. Notable among these are some of the famed Finger Lakes, in upstate New York.

Build-up of Dissolved Solids in the Lakes

Waste inputs to the Lakes have also resulted in a build-up in average concentrations of dissolved constituents such as chlorides, sulfates, and the hardness-producing salts. The rate of build-up is increasing in Lake Michigan, for example, where the chloride concentration has doubled since 1910, increasing from 4 to 8 mg/l. Sulfates are increasing at a slightly greater rate, averaging about 1 mg/l in 7 years. The present sulfate level in Lake Michigan is 20 mg/l.

Although these concentrations are well below levels that would seriously impair water uses, they are heavily influenced by population and industrial growth. Localized problems are being experienced in the vicinity of heavy waste input points. These problems emphasize the need to prevent indiscriminate dumping of unwanted materials into the Lakes.

Bacterial Contamination of the Lakes and Tributaries

Another indication of deteriorated water quality, and one which can be traced more directly to man, is the presence of coliform bacteria. Coliform organisms are significant because they occur in the fecal matter of all warm-blooded animals, including man. Consequently, the presence of these bacteria in a body of water is interpreted as evidence of fecal contamination. Since contamination of water by fecal matter is one avenue of transmission of certain water-borne diseases, the presence of coliforms is an indication of a potential health hazard.

Studies have shown that the bacterial quality of Lake Michigan is generally good in deep water but is degraded along the shoreline and in harbor areas. High bacterial densities show a close correlation with heavily populated areas. Evidence of severe bacterial contamination of tributaries to Lake Michigan has been found in the Fox River between Lake Winnebago and Green Bay, Wisconsin; the Milwaukee River within Milwaukee County, Wisconsin; and the streams of the Calumet Area, Illinois and Indiana.

Tributaries of Lakes Erie and Ontario introduce fairly high quantities of polluted water, but the main bodies of the Lakes are not considered to be bacterially contaminated. As the tributaries enter the Lakes, their waters mix and dissipate the pollutional load with the Lakes and, except for harbor-inshore areas in close proximity to or downflow of tributaries, the quality remains good. The Niagara River, the connecting link between Lakes Erie and Ontario, is severely polluted in terms of bacterial contamination.

Generally the severe problems of bacterial contamination in the Great Lakes Area are located around the population centers. But, of course, this is precisely where the great demands for water usage occur. Many Great Lakes beaches are currently closed because of health hazards.

The large number of vessels, commercial ships and recreational boats, now plying the waters of the Great Lakes and their tributaries also represent significant sources of both untreated and inadequately treated wastes capable of causing local problems of bacterial pollution.

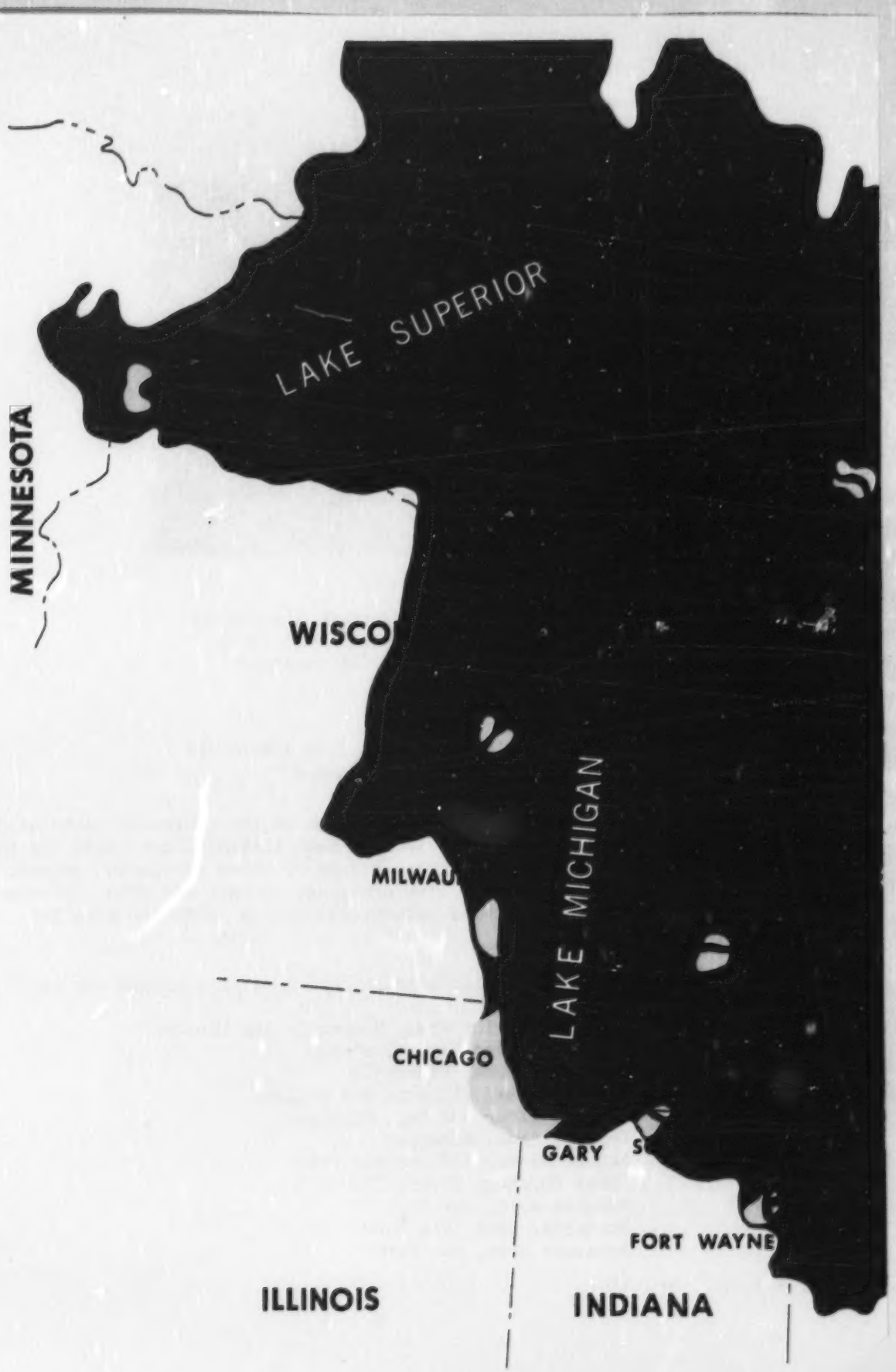
To close or not to close the beach?
This is the way one Great Lakes
city approaches the question.

Chemical Contamination from Industrial Waste Discharges

Industrial plants have been identified as the source of waste discharges causing chemical contamination of water. Such contamination takes the form of oil and tarry substances, phenolic compounds or other persistent organic chemicals contributing to taste and odor problems, ammonia and other nitrogeneous materials, phosphorus, suspended matter, and highly acidic or alkaline materials.

The principal areas exhibiting pollution of this nature are as follows:

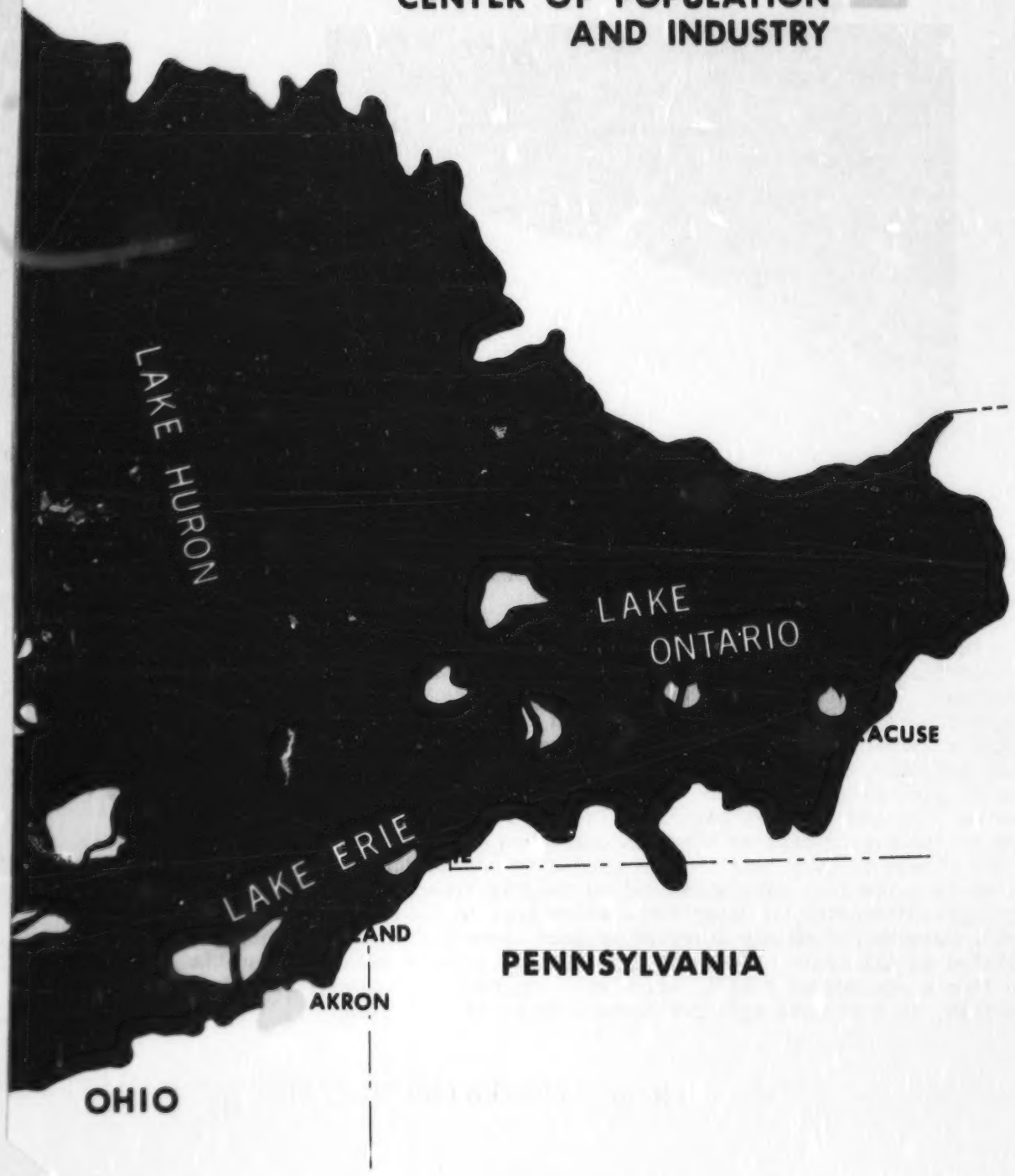
Duluth-Superior Area, Minnesota and Wisconsin
Southern Green Bay, Wisconsin
Milwaukee Area, Wisconsin
Calumet Area, Illinois and Indiana
Saginaw River and Bay, Michigan
Detroit Area, Michigan
Maumee River, Indiana and Ohio
Lower Cuyahoga River, Ohio
Niagara Area, New York
Rochester Area, New York
Syracuse Area, New York


LAKE SUPERIOR
MINNESOTA
WISCO
MILWAU
LAKE MICHIGAN
CHICAGO
GARY
FORT WAYNE
ILLINOIS
INDIANA

THE GREAT LAKES AREA

GREAT LAKES AND MAJOR RIVERS

CENTER OF POPULATION AND INDUSTRY

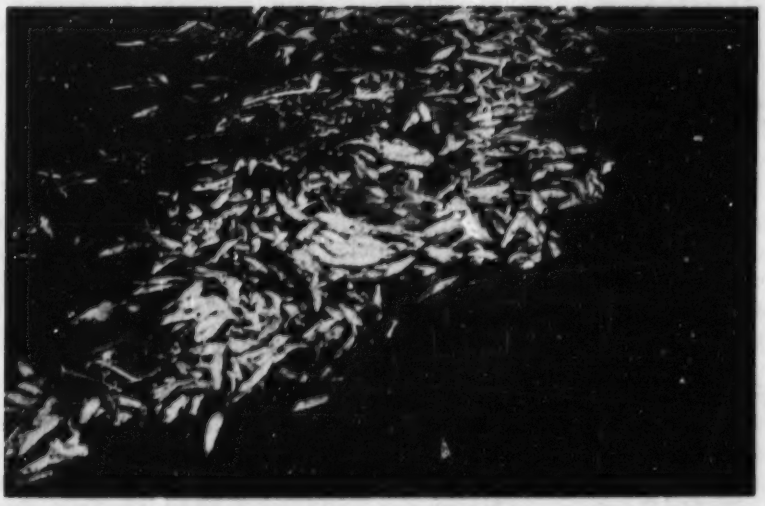


Industrial wastes produce unsightly conditions, contribute to taste and odor problems and treatment problems at water treatment plants, and in some cases are toxic to desirable fish and aquatic life. The detrimental effects of these chemicals on man have not been fully evaluated.

Paper mill wastes - one of the largest causes of pollution.

Oxygen Depletion of the Lakes and Tributaries

The small quantity of oxygen normally dissolved in water is perhaps the most important single ingredient necessary for a healthy, balanced, aquatic environment. Dissolved oxygen is consumed by living organisms through respiration and is replenished, if a well-balanced environment exists, by absorption from the atmosphere and through the life processes, of aquatic plants. When organic pollution enters this environment, the balance is altered. The bacteria, present in the water or introduced with pollution, utilize the organic matter as food and multiply rapidly. The resulting deficiency may be great enough to inhibit or destroy the fish and other desirable organisms and to convert the stream or lake into an odor-producing nuisance. Solubility of oxygen in water is quite low, saturation values ranging from 8 to 13 milligrams per liter (mg/l) depending on water temperature and, in lesser degree, on atmospheric pressure. Commonly accepted minimum concentrations that should be maintained at all times to prevent nuisance and promote desirable aquatic life, range from a minimum of 3 mg/l, which will support minimal aquatic life and rough fish, to 6 or more mg/l for certain types of game fish.



Both sport and commercial fishing
are affected by pollution.

As previously mentioned, the main body of Lake Erie has exhibited oxygen depletion in widespread areas due primarily to widespread algal blooms. Oxygen depletion has also been observed in some of the major tributaries to Lake Michigan. Prime examples of this water quality problem are the Lower Fox River, the Grand River below Jackson and Lansing, and the Calumet Area streams. Tributaries to Lake Ontario at the Barge Canal, Black River, Rochester, and Lockport Areas have also demonstrated poor dissolved oxygen resources.

In general the discharge of treated and untreated municipal and industrial wastes in these areas produces these polluted conditions. The high concentrations of biochemical oxygen demand (BOD) in the waste discharges combine, in some cases, with severe drought flows of receiving waters to intensify the problems of this nature.

Management Problems

Although the physical problems discussed above are very complex, their solution depends in turn upon the solution of extremely complex economic and political problems. One of the primary problems is the diversity of, and need for coordination between, the large number of organizations at all levels of government which have an interest in and authority for various phases of water pollution control. Two Nations, Canada and the United States, a number of international and interstate organizations, eight States and two Provinces, and many local communities are actively involved in the control of water pollution in the Great Lakes.

WHAT IS BEING DONE

Federal Activities

National Program

Increasing interest and concern over the widespread problems related to water pollution are reflected in Federal legislation, particularly during the past 10 years. The Water Quality Act of 1965 is the most recent and one of the most significant legislative milestones. This Act amends the Federal Water Pollution Control Act of 1956, which was previously amended in 1961.

The basic Act, as amended in 1961, authorized certain water pollution control activities. The major program activities included the development of comprehensive water pollution control programs, research, technical assistance, training, grants for state programs and the construction of sewage treatment facilities, enforcement, and pollution control from Federal installations. A Federal program of this stature required substantial resources in personnel, facilities, and funds. The years 1961 through 1965 were a period of widely expanding effort in the war on water pollution. Ten of the Nation's major basins, including the Great Lakes, were under study for the development of comprehensive programs. The construction grants program, from its beginning in 1956 to the middle of 1966, granted over $775 million in Federal funds to help finance some 6,940 municipal sewage treatment projects. Equally important, 39 Federal-State enforcement conferences have brought recommended measures and schedules for pollution abatement.

The Water Quality Act of 1965, previously mentioned, established a new Federal Water Pollution Control Administration, increased dollar ceilings on sewage treatment construction grants, and authorized an additional 10 percent for any such grant conforming with metropolitan or regional master development plans. The Act requires the development of water quality standards for interstate waters, and also authorizes grants for demonstrating new or improved methods for controlling wastes discharged from storm or combined sanitary and storm sewers. One such grant was announced by President Johnson during his visit to Buffalo in August, 1966, to personally view pollution in the Great Lakes. The new provisions of the Act were designed to strengthen and expand the collective effort in attaining adequate pollution control throughout the country.

Research

In the 1961 amendments to the Federal Water Pollution Control Act, Congress directed the Secretary of Health, Education, and Welfare to develop and demonstrate practicable means of treating sewage and other waterborne wastes to restore the Nation's waters to a quality suitable for reuse. Of the funds appropriated, $5 million annually up to an aggregate of $25

million, about $5.4 million have been allocated to the advanced waste treatment research effort. Encouraging progress has resulted and initial research has indicated that advanced waste treatment can be made both technologically and economically feasible. The most promising processes developed to date are: 1) foam separation, 2) coagulation - solids removal, 3) granular carbon adsorption, and 4) electrodialysis. Much research and development work remains to be done, however, before the essential goal of accomplishing any degree of waste treatment required, at any location, under any condition, and at a minimum cost that technology can achieve, is reached.

Recent investigations of phosphate removal efficiencies in conventional municipal sewage treatment plants have also proved rewarding. It appears that relatively minor modifications in plant operation can result in much higher phosphate removal efficiencies. The value of such research findings could prove quite significant, particularly in the Great Lakes where many of our large communities discharge large phosphate loadings to the Lakes and algal problems have resulted.

Water Quality Standards

As previously mentioned the Water Quality Act of 1965 requires the establishment of water quality standards for all interstate waters. There is general agreement as to the need for, and the benefits attainable from, this provision.

Each State has the opportunity of filing, by October 2, 1966, a letter indicating its intent to adopt, on or before June 30, 1967, water quality criteria and a plan for implementing and enforcing such criteria, for the interstate waters and portions thereof within its jurisdiction. If such criteria and plan are so established and are determined by the Secretary of the Interior to be consistent with the provisions of the Act, then the criteria and plan will become the water quality standards applicable to the waters involved. If a State fails to establish quality standards, the Federal Government, through carefully delineated procedures, will do so.

Establishment of water quality standards for all our Nation's interstate waters will be a monumental achievement. Many persons representing a wide variety of disciplines will be involved; many more will be affected. Nearly all of our States have indicated their intention to adopt standards by the mid-1967 deadline. On May 10, 1966, when the Federal Water Pollution Control Administration became a part of his Department, Secretary of the Interior Stewart L. Udall issued guidelines to the States for setting of standards. In a message to the 50 State Governors, the Secretary urged a cooperative State-Federal effort in the establishment and implementation of water quality standards. This partnership approach is the key to successful accomplishment of the standards provision of the Federal Water Pollution Control Act. The pace of progress will depend greatly upon the leadership and impetus provided by responsible officials in each State. The Federal Water Pollution Control Administration stands ready to give all possible support and assistance - administratively, technically, and financially.

Federal Installations

The Federal Government has not overlooked the pollution hazards created by its own activities. On November 17, 1965 President Johnson issued Executive Order 11258, Prevention, Control, and Abatement of Water Pollution by Federal Activities. The Order was later revised by Executive Order 11288 which placed the responsibilities of the original Order under the Department of the Interior. The Order directs the heads of the departments, agencies, and establishments of the Executive Branch of the Government to provide leadership in the nation-wide effort to improve water quality.

All agencies have been directed to present a phased and orderly plan for needed corrective and preventive measures and facilities to the Bureau of the Budget in order to facilitate budgeting procedures. In addition, all Federal installations are required to provide a minimum of secondary waste treatment. Federal installations such as Air Force bases, NIKE Sites, Army ammunition plants and depots, Job Corps Centers, National Forest recreation facilities, and Coast Guard stations in the Great Lakes Area have initiated pollution abatement programs in furtherance of the Order. General improvement in housekeeping and surveillance as well as the upgrading of existing waste treatment facilities have resulted from each agency's desire to provide the leadership necessary to effect the Nation's goal of clean water.

Federal water resources projects and facilities and operations supported by Federal loans, grants, or contracts are also included in Executive Order 11288. Water resource projects must be designed, constructed, and operated in a manner which will reduce pollution from such activities to the lowest practicable level. The head of each Federal department, agency, and establishment has been directed to conduct a review of the loan, grant, and contract practices of his own organization to determine to what extent water pollution control requirements set forth in the Order should be adhered to by borrowers, grantees, or contractors. This review has resulted in practices designed to reduce water pollution in various programs. Urban renewal projects now require the construction of separate storm and sanitary sewer systems rather than combined systems. The nation-wide highway construction program, financed with Federal funds and administered by the Bureau of Public Roads, is now being conducted in accordance with practices aimed at preventing water pollution through their design, construction, and maintenance. The various agencies have consulted with the Federal Water Pollution Control Administration in an effort to insure maximum water quality consideration in their various activities.

The U. S. Army Corps of Engineers is reviewing its harbor and waterway dredging operations in an effort to reduce water pollution. The disposal of dredgings in diked areas and other suitable spoil areas rather than disposal in open waters will aid in overall water quality enhancement.

This Order represents a major step forward in the battle to preserve and enhance the quality of our Nation's waters. It has sparked a keen awareness on the part of government officials of the need for corrective action and

vigorous pollution abatement programs. The effort being shown by these various Federal agencies provides leadership in the nation-wide water quality improvement program.

Enforcement Action-Great Lakes Area

Under the provisions of the Federal Water Pollution Control Act, the Secretary of the Interior is authorized to call an enforcement conference when requested to do so by the Governor of a State, and when, on the basis of reports, surveys, or studies, he has reason to believe that pollution of interstate waters subject to abatement under the Act is occurring.

The purpose of the conference is to bring together the State water pollution control agencies, the representatives of the Department of the Interior, and other interested parties to review the existing situations, the progress which has been made, to lay a basis for future action by all parties concerned, and to give the States, localities, and industries an opportunity to take any indicated remedial action under State and local laws.

There have been four such Federal-State enforcement actions in the Great Lakes Area.

Conference Area	States Involved	Date
Detroit River-Western Lake Erie	Michigan	March 27, 1962 (Reconvened on June 15, 1965)
Menominee River	Michigan & Wisconsin	November 7, 1963
Calumet Rivers & Lake Michigan	Indiana & Illinois	March 2, 1965 (Technical Session January 4, 1966)
Lake Erie and its Tributaries	Pennsylvania, New York, Michigan, Indiana, and Ohio	August 3, 1965 (Cleveland) August 10, 1965 (Buffalo) (Conferees Meeting June 12, 1966)

The conclusions and recommendations reached by the conferees cover subjects peculiar to the problems of each conference area. In the Menominee Conference pulp and paper wastes were the greatest contributors to pollution. In Lake Erie the prime concern was over-fertilization that causes excessive algae growths.

Because of these differences, clean-up agreements and policies have been reached covering several aspects of pollution control. These clean-up agreements vary from one conference area to another. The required control

measures range from "construction and operation of sewage treatment plants for maximum phosphate removal" to "prevention of garbage dumping along streams and lake shorelines."

Comprehensive Program-Great Lakes Area

The Great Lakes-Illinois River Basins Project has been charged with the responsibility of developing comprehensive programs for the Great Lakes and Illinois River Basins. The major objectives of the comprehensive program are:

----Identification of the causes of water pollution and the effects of such pollution on the quality of water resources and on beneficial uses.

----The development of agreements on the desired beneficial uses and the water quality required to accommodate those uses.

----The development of water quality control measures to achieve the desired objectives, including the establishment of a timetable for their accomplishment.

----Provision of the mechanisms for carrying out program objectives, including continuing surveillance for the purpose of updating the programs to accommodate changing technology and changing water quality needs.

To accomplish these objectives the Project has a staff consisting of professional personnel of a variety of scientific disciplines including sanitary and hydraulic engineers, chemists, biologists, microbiologists, radiochemists, oceanographers and economists. All work is closely coordinated with other Federal, State and local interests.

Project activities began late in 1960 with a concentrated information gathering phase which included the development of municipal and industrial water and waste inventories, gathering of economic base data, and intensive sampling of waters in selected areas considered critical from a water pollution standpoint. Simultaneously, the Project staff in cooperation with its Lake Michigan-Illinois River Basins Technical Committee developed water quality criteria to serve as goals for various water uses in the Lake Michigan Basin.

In the Lake Michigan Basin the field work and two reports have been completed. The two reports on the Milwaukee and Green Bay Areas in Wisconsin were presented at the Governor's Conferences on Lake Michigan Pollution held at Milwaukee and Green Bay on June 28 and June 30, 1966, respectively. Reports describing the comprehensive programs for water pollution control in other areas of the Lake Michigan Basin are now in preparation. Field activities have been completed in the Lake Erie, Lake Huron and Lake Ontario Basins. Reports are scheduled for completion for the Lake Michigan and Lake Erie Basins by January, 1967. The Lake Huron and Lake Ontario Basin reports are scheduled for completion by July, 1967. Field studies are scheduled to begin on the Lake Superior Basin in January, 1967.

GPO 827-497-3

State Activities

All Federal water pollution control legislation has recognized that the primary responsibility for the control of pollution resides in the States. The rising public concern over water pollution which has resulted in stronger laws at the Federal level has also had a significant impact on State water pollution control legislation.

The eight States that border the Great Lakes are among the richest and most progressive in the Nation and their approach to the problems of water resource management is broad. The tools available to the State governments in their anti-pollution efforts range from the power to prohibit waste discharges to the use of tax incentives to encourage the construction of needed facilities.

An example of recent water resource legislation is the new Wisconsin law which went into effect August 1, 1966. The law provides for financial aid to local communities, the establishment of water quality criteria for the waters of the State, and for comprehensive planning by regions within the State. In addition the staff and funds of the water resource agency were greatly increased. In the State of New York a bond issue totaling approximately one billion dollars for the construction of sewage treatment facilities was passed last year. Other States in the Great Lakes Area have also shown significant increases in the amount of funds allocated to State water pollution control programs. The Governors of several Great Lakes States have shown their interest in the pollution problem in their respective States by calling conferences to emphasize the seriousness of the problems.

The above factors indicate that the States are becoming increasingly aware of their central role in water pollution control, and that they must do much more in the future than has been done in the past.

Regional and Local Activities

In recent years there has been an increase in the number of regional planning agencies concerned with the water pollution problems of metropolitan areas. However, such regional agencies do not at the present time have sufficient funds, manpower or authority to adequately implement the master plans needed for our complex urban areas.

Local pollution control activities often receive less recognition than the actions taken at the Federal and State levels. It is essential to realize, however, that remedial action to correct many of our major water pollution problems must ultimately be taken at the local level. There are many signs that our municipalities are becoming increasingly aware of their pollution problems and are taking appropriate steps to eliminate them.

Industrial Activities

Industries in the Great Lakes Area are demonstrating their concern over the problems of water pollution. Many leaders of industry have come to the

realization that the cost of pollution control is a necessary and legitimate cost of production. Planning for pollution abatement is an integral part of the construction of new plants, and methods to reduce the pollutional load from older plants are receiving much attention.

Interstate and International Cooperation

Several organizations have been established to attempt to deal with the complex interstate and international problems of water resources management in the Great Lakes Area.

The Great Lakes Commission, although not recognized as an interstate compact, is composed of the States of Wisconsin, Michigan, Minnesota, Indiana, Pennsylvania, Illinois and New York. It was formed to conserve and develop the water resources of the Great Lakes Area.

The Great Lakes Study Group is composed of representatives of several Canadian and U. S. government agencies, formed on an informal basis to exchange technical information concerning studies of the Great Lakes.

The Great Lakes Fisheries Commission was established by the United States and Canada in accordance with the terms of the Convention on Great Lakes Fisheries ratified in 1955. Its major functions are to formulate and carry out research programs to protect the fisheries of the Great Lakes Area.

The Boundary Waters Treaty between the United States and Canada, signed in 1909, established the International Joint Commission. The Commission appointed two Advisory Boards on Control of Pollution of Boundary Waters, composed of Federal and State engineers from the two Nations, to examine and evaluate pollution problems and to interpret progress of abatement programs. Since 1952, field units have been maintained by the U. S. in Detroit and Buffalo to collect basic water quality data, study tran boundary travel of pollution, determine improvements resulting from municipal and industrial waste treatment, assemble data on water uses, and apply new analytical techniques in boundary water pollution control investigations. In October, 1964, the Commission was requested by Canada and the U. S. to report upon pollution in the waters of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River. An Interim Report on the subject was prepared by the Commission in December, 1965. Recommendations were made for the maximum possible removal of phosphates from all municipal and industrial waste discharges, the prohibition of the construction of combined sewer systems, and the separation of existing systems, and an effective system of sampling effluents of waste sources. A program of investigation and research was also recommended.

In order to establish effective organizations to plan basin-wide water resource management programs, Congress passed significant legislation in 1965. The Water Resources Planning Act provides for the creation of river basin commissions. Each commission would serve as the principal agency for the coordination of Federal, State, interstate, local and non-governmental plans for the development of water and related land resources in its area. The Great Lakes States have already requested that a commission be established for their area.

ACTION NEEDED

Although engineering and economic analyses for developing the final program for the Great Lakes Area are still in progress, work has advanced to the point that many of the improvement measures necessary to achieve program objectives have been determined. Some of these measures apply present technology to problems needing immediate correction and are based on experience gained in solving similar problems elsewhere. The immediate actions needed are listed below.

1. All municipal waste treatment facilities should be designed to provide at least secondary (biological) waste treatment. Such facilities should be efficiently and continously operated to achieve an overall 90 percent, or higher, removal of the untreated waste load, as measured in terms of oxygen-consuming wastes.

2. Continous disinfection should be provided for all municipal waste treatment plant effluents.

3. All separately discharging industrial wastes should receive the equivalent of at least secondary treatment, as described above. Action should also be taken toward the exclusion or treatment of industrial wastes causing chemical pollution. Where practicable, industrial wastes should be discharged to municipal sewerage systems.

4. Organic wastes and sanitary sewage discharged by industries should receive the same treatment as recommended for municipal wastes.

5. Maximization of phosphate removal, through modification in the operation and/or design of existing and newly constructed secondary waste treatment facilities should be an immediate objective. Records of phosphorus removal at treatment plants should be carefully evaluated after one year to determine if significant phosphorus removals have been achieved. If such removals are not achieved, consideration should be given to the installation of chemical precipitation facilities at such plants.

6. Combined sewers should be prohibited in all newly developed urban areas and should be separated in coordination with urban renewal projects. Existing combined sewer systems should be patrolled and overflow regulating devices should be adjusted to convey the maximum practicable amount of combined flow to treatment facilities.

7. Agricultural practices should be reviewed to ensure the maximum protection of the waters of the Great Lakes from the improper application of fertilizers and pesticides. The use of pesticides and herbicides should be more closely scrutinized. At a minimum, accurate estimates of quantities utilized on a county basis should be developed. This will aid in pinpointing potential problem areas.

8. Where practicable, waste heat discharges, particularly from steam power plants, should be reduced where other water uses are adversely affected. In the planning of new installations requiring large amounts of cooling water, the quality requirements of the receiving bodies of water should be a prime factor in determining the location of such installations and the need for cooling towers to dissipate heat.

9. Master plans for future waste collection and treatment facilities should be developed for the rapidly urbanizing metropolitan areas as quickly as possible. Such plans should provide, among other things, for maximum use of integrated facilities which will permit eventual elimination of the conglomeration of small, inefficient facilities surrounded by residential and commercial development. Master plans should encompass whole metropolitan areas and should not be restricted by political boundaries.

10. The Federal Water Pollution Control Administration has been working closely with other Federal agencies and with equipment manufacturers in the development of efficient miniaturized waste disposal units for recreational boats. Regulations have been proposed by the U. S. Public Health Service to control the discharge of sewage and other wastes from commercial vessels both domestic and foreign. Forceful action is needed now at all levels of government to control and prevent pollution from these mobile and largely uncontrolled waste sources.

11. The off-shore disposal of dredgings from harbor and channel areas which contain residues from the sewage of cities and industries is a poor practice, if the quality of the water of the Great Lakes is to be maintained. It is recommended that those involved in such practices provide other means of disposal which will not adversely affect the water quality of the Lakes.

12. Monthly reports covering the operation of all municipal and industrial waste treatment plants including the quality and quantity of discharged effluent should be submitted to the appropriate State agencies for review, evaluation and appropriate action.

13. The operation of all streamflow regulation facilities should be reviewed to ensure the availability of the maximum practicable streamflow at all times.

14. The water quality monitoring programs of the State agencies of the Great Lakes Area should be strengthened. The programs should be geared to indicate change or trends in water quality and the need for additional quality improvement measures. The use of automated equipment in key locations is recommended.

15. State agencies should conduct waste treatment plant inspections at least annually for small and medium-sized plants, and at least twice annually for the larger plants.

16. It is recommended that the water pollution control activities in each of the Great Lakes States be strengthened in terms of staffing and budget. With additional resources and the support available from the Federal Water Pollution Control Administration the implementation of the program outlined herein can be accelerated to meet the growing need for clean water.

Its 30-mile lakefront is today the pride of Chicago, because 70 years ago the pollution was shifted to other waters...

...the other waters are still polluted.

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